



Sector Specific Technology Transfer Guide

Structural Wood Products Industry

(SIC Group 243, Millwork, Veneer, Plywood, and Structural Wood Members)



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This guide was developed to provide an overview of pollution prevention practices and technologies available to the structural wood products industry. The pollution prevention strategies identified in this guide focus primarily on the reduction of air emissions. The guide has been organized by production processes and the pollution prevention strategies, and categorized by the initial costs of those technologies. Each technology is ranked according to the potential reductions in air emissions resulting from the implementation of those technologies (☼ = a low potential for significant emission reductions, ☼☼☼☼ = the highest potential for significant emission reductions).

Gluing and Adhesive Bonding Operations

Low Cost Pollution Prevention Technologies:

- **Polyurethane hot melt glues (☼☼☼☼)** – Replace solvent-borne structural and edgebanding glues with polyurethane hot melt glues.
- **Polyvinyl acetate (PVA) glues (☼☼☼☼)** – Replace solvent-borne glues with an aqueous-based PVA glue.
- **Waterborne adhesives (low to no-formaldehyde formulations) (☼☼☼☼)** – Replace solvent-borne adhesives with aqueous-based adhesives.
- **Operator training (☼☼☼)** – Conducting hands-on training sessions in proper spray techniques for employees applying atomized adhesives using manual application processes.
- **Keep all containers closed** (this includes all containers used to store adhesives, solvents, additives, and liquid waste materials) (☼) – To reduce air emissions and preserve the chemical properties of the coatings and solvents, instruct all employees to keep containers used to store these materials closed when not in use.
- **Inspect coating storage, transfer, and application equipment (☼)** – On a regular basis, inspect storage container, transfer equipment, and application equipment used to store, transfer or apply solvent-borne adhesives and solvents for leaks or malfunctions.

Medium Cost Pollution Prevention Technologies:

- **Soy-based adhesives (☼☼☼☼)** – Use soy adhesives in combination with phenol-formaldehyde or urea-formaldehyde adhesives in the production of particle board, strand board, or plywood.
- **Corn starch-based adhesives (☼☼☼☼)** – Use corn starch-based adhesives for finger-joining scrap wood into structural lumber.
- **High volume low pressure (HVL) application equipment (☼☼☼)** – Replacing conventional atomized spray equipment with HVL spray equipment.

- **Methylenediphenyl (MDI) resins (☼☼☼)** - Replace phenol-formaldehyde and/or urea-formaldehyde adhesives with MDI resin. (Note: Acute inhalation of high concentrations of MDI may cause sensitization and asthma, and skin contact may cause dermatitis.)
- **Enclosed spray gun wash systems (☼)** – Use an enclosed gun wash system to clean conventional and HVLP spray application equipment.

High Cost Pollution Prevention Technologies:

- **Waterborne heat seal adhesives (☼☼☼☼)** - Replace solvent-borne adhesives used to apply laminates with an aqueous-based hot seal adhesive, using a roller or press system along with low heat to bond the substrates.
- **Roll coat application (☼☼☼☼)** – Replace atomize application equipment with a roll coat application system.

Surface Coating Operations

Low Cost Pollution Prevention Technologies:

- **Operator training (☼☼☼)** – Conducting hands-on training sessions in proper spray techniques for employees applying atomized coatings using manual application processes.
- **Keep all containers closed** (this includes all containers used to store coatings, solvents, additives, and liquid waste materials) (☼) – To reduce air emissions and preserve the chemical properties of the coatings and solvents, instruct all employees to keep containers used to store these materials closed when not in use.
- **Inspect coating storage, transfer, and application equipment (☼)** – On a regular basis, inspect storage container, transfer equipment, and application equipment used to store, transfer or apply solvent-borne coatings and solvents for leaks or malfunctions.
- **Monitoring of coatings defects (☼)** – Track the number of coatings defects, the type of defects detected, and the spraybooth or production line generating the defects. Use this information to determine the source of the defects and take corrective actions to reduce or eliminate future coatings defects.

Medium Cost Pollution Prevention Technologies:

- **Waterborne coatings (☼☼☼☼)** – Replace solvent-borne coatings with low-to-no VOC/HAP waterborne coatings.
- **High solids paints and topcoats (☼☼☼)** - Replace low solids solvent-borne coatings with low VOC/HAP high solids coatings.
- **High volume low pressure (HVLP) application equipment (☼☼☼)** – Replace conventional atomized spray equipment with HVLP spray equipment.
- **Enclosed spray gun wash systems (☼)** – Use an enclosed gun wash system to clean conventional and HVLP spray application equipment.
- **Hard pipe system (☼)** - Transfer VOC/HAP containing materials by means of a hard pipe system.

High Cost Pollution Prevention Technologies:

- **Powder coatings (☼☼☼☼)** – Replace solvent-borne coatings with powder coatings.
- **UV curable coatings (☼☼☼☼)** – Replace solvent-borne coatings with UV curable coatings.

- **Vacuum coating** (☼☼☼☼) - Replace atomized coating systems with a vacuum coating system using waterborne coatings.
- **Roll Coating** (☼☼☼☼) – Replace atomized coating application equipment with a roll coating system.
- **Electrostatic application equipment** (☼☼☼☼) – Replace conventional spray equipment with electrostatic applications equipment.
- **Air-assisted airless application equipment** (☼☼☼) – Replace conventional spray equipment with air-assisted airless application equipment.
- **Curtain coating** (☼☼☼) - Replace atomized coating application equipment with a curtain coating system.

Chemical Stripping

Low Cost Pollution Prevention Technologies:

- **Low HAP/VOC chemical strippers** (☼☼☼☼) – Replace traditional methylene chloride-based strippers with low HAP/VOC strippers.
- **Monitoring of coatings defects** (☼) – Track the number of coatings defects, the type of defects detected, and the spraybooth or production line generating the defects. Use this information to determine the source of the defects and take corrective actions to reduce or eliminate the need for chemical stripping.

Printing Operations

Low Cost Pollution Prevention Technologies:

- **Keep all containers closed** (this includes all containers used to store inks, solvents, additives, and liquid waste materials) (☼) – To reduce air emissions and preserve the chemical properties of the coatings and solvents, instruct all employees to keep containers used to store these materials closed when not in use.
- **Inspect coating storage, transfer, and application equipment** (☼) – On a regular basis, inspect storage container, transfer equipment, and application equipment used to store, transfer or apply solvent-borne inks and solvents for leaks or malfunctions.

Medium Cost Pollution Prevention Technologies:

- **Soy-based inks** (☼☼☼☼) – Replace solvent-borne inks with soy-based inks.
- **Waterborne inks** (☼☼☼☼) – Replace solvent-borne inks with waterborne inks.

High Cost Pollution Prevention Technologies:

- **UV curable inks** (☼☼☼☼) – Replace solvent-borne inks with UV curable inks.

Links to Additional Information

Gluing & Adhesive Bonding Operations:

Soy-Based Adhesives

- Pacific Northwest Pollution Prevention Resource Center:
www.pprc.org/pprc/pubs/newslets/news0600.html

Corn Starch-Based Adhesives

- USDA Agricultural Research Service: www.ars.usda.gov/is/AR/archive/apr00/wood0400.htm

Glues and Adhesives (General)

- Profile of the Lumber and Wood Products Industry (USEPA):
<http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/lumber.html>
- Minnesota Office of Environmental Assistance, Reconstituted Wood Sector Notebook:
www.moea.state.mn.us/publications/SIC2493.pdf
- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/holiday-rambler

Surface Coating Operations:

Powder Coating

- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/MDF.pdf
- EPA Case Study: www.epa.gov/ttnatw01/wood/low/downloads/knollcs.pdf

High Solids Coatings

- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/middle
- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/innvtech

Low HAP Coatings

- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/swiss
- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/woodcrest
- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/Woodcrest2000.htm

UV Curable Fillers

- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/Swiss2000.htm

Operator Training

- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/NESHAPP3

Electrostatic Coatings Application:

- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/childcraft
- CMTI Case-Study: www.ecn.purdue.edu/CMTI/Technology_Transfer/cccarlp2

Coatings (General)

- Paint and Coatings Resource Center www.paintcenter.org/
- University of Wisconsin-Extension Madison, Wisconsin Center for Environment and Energy, Wood Products Value-Added Manufacturing and Efficiency Guide:
www.uwex.edu/ces/ag/sus/wood/sections.htm
- Coatings Guide™: cage.rti.org/

Printing Operations

- Printers National Environmental Assistance Center www.pneac.org/


Additional Sites

- Pollution Prevention Resource Exchange: www.p2rx.org/
- Indiana Clean Manufacturing Technology & Safe Materials Institute: www.ecn.purdue.edu/CMTI/
- IDEM's Office of Pollution Prevention & Technical Assistance: www.in.gov/idem/oppta/

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Summary Table

| | Good Pollution Reduction Opportunities → | | Best Pollution Reduction Opportunities |
|---|--|--|--|
| Lowest Cost  | <ul style="list-style-type: none"> Keep containers closed (<i>G, SC, P</i>) Inspect equipment (<i>G, SC, P</i>) Monitor coating defects (<i>SC, CS</i>) | <ul style="list-style-type: none"> Operator training (<i>G, SC</i>) | <ul style="list-style-type: none"> Polyurethane hot melt glues (<i>G</i>) Aqueous-based PVA glue (<i>G</i>) Waterborne adhesives (<i>G</i>) Low HAP/VOC strippers (<i>CS</i>) |
| | <ul style="list-style-type: none"> Enclosed spray gun wash system (<i>G, SC</i>) Hard pipe transfer system (<i>SC</i>) | <ul style="list-style-type: none"> HVLP application equipment (<i>G, SC</i>) Methylenediphenyl (MDI) Resins (<i>G</i>) High solids paints and topcoats (<i>SC</i>) Soy-based inks (<i>P</i>) Waterborne inks (<i>P</i>) | <ul style="list-style-type: none"> Soy-based adhesives (<i>G</i>) Corn Starch-based adhesives (<i>G</i>) Waterborne coatings (<i>SC</i>) |
| | | <ul style="list-style-type: none"> Air-assisted airless equipment (<i>SC</i>) Curtain coating (<i>SC</i>) | <ul style="list-style-type: none"> Waterborne heat seal adhesives (<i>G</i>) Roll coat application (<i>G, SC</i>) Electrostatic equipment (<i>SC</i>) Powder coatings (<i>SC</i>) Vacuum coating (<i>SC</i>) UV curable coatings/inks (<i>SC, P</i>) |

G - Gluing and Adhesive Bonding Operations

SC - Surface Coating Operations

CS - Chemical Stripping Operations

P - Printing Operations